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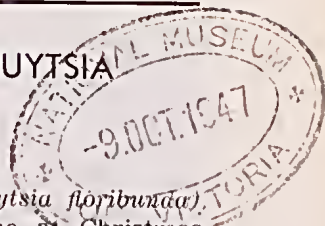
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ARTIFICIAL PROPAGATION OF NUYTSIA FLORIBUNDA

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The Western Australian Christmas Tree (*Nuytsia floribunda*) so called from its mass of golden blossom borne at Christmas time, is a tree of from 25-30 feet in height, a root parasite, and a member of the mistletoe family (*Loranthaceae*). In nature, seed is set freely and though the germination ratio appears to be fairly high, unfortunately the seedlings rarely reach maturity. Reproduction in the native state is normally by means of root suckers which are given off at some distance from the parent plant, so adjacent trees are commonly connected by means of underground stems. Thus the spectacular flowerings which are a delight to all observers in the early summer months appear to have, at this stage of the plant's evolution, lost their biological utility.

Among horticulturists, propagation has been considered rare and difficult, seedlings failing mainly, it was believed, because the roots did not reach a suitable host before the food supply of the seed was exhausted.

Mr. O. Dowell, formerly head gardener of the University of Western Australia, had some success in growing the plant to maturity by germinating the seed in pots of couch grass. Apparently a host-parasite relationship was established and seed so planted produced plants which flowered in about six years. The present gardener, Mr. George Muns, has numerous plants which he has grown in this way.

The trial related below had its beginning in a habit of the author of collecting seeds of native plants while walking in the bush and then attempting to germinate them in pots at home. The process was very casual and no records were kept. In this manner, over a period of two years, attempts were made to grow *Nuytsia*. Seeds collected in the summer were germinated in trays, but the number germinating was very small and none grew beyond the cotyledon stage. About May of the second season, germinated seeds were brought from the bush and placed in various pots in close proximity to plants which it was hoped would prove suitable hosts. This met with little success and only one plant (growing with *Eucalyptus torquata*) lived for any

length of time, and even this failed to survive the second summer. It was never discovered whether this plant had established a host-parasite relationship or not.

No further tests were carried out during the period 1941-45, but during the late summer and autumn of 1946 more seed was collected in preparation for another approach to the problem. It was reasoned that, if the host-parasite relationship was all that the young plant required in order to reach maturity, then surely



FIG.1.—Specimens of Group (b) ii, showing root development, September, 1946

sufficient opportunity existed under natural conditions for this to be established and therefore, considering the number of seeds set, at least a small percentage should grow by chancing on a host plant before the seed stores were depleted. In view of the fact that natural propagation does not occur in this way, the non-finding of a host was not considered the essential factor causing the early death of the young plant.

From the appearance of the young seedling when grown in pots and about to die, the probable cause of death was inferred as follows:

The cotyledons and first shoot of the dying plant are green and usually still attached to the seed, while the root begins to turn brown at the tip, the discoloration moving progressively up the root. At about the same time, when the root is rarely over half an inch long, the green parts begin to wither and shrivel. When healthy, the root appears quite waxy and shiny and, although no microscopic examination was made, it was assumed that faulty root formation was the cause of the early death.

Using the foregoing as a working hypothesis, it was decided to try a proprietary root-promoting substance (Hortomone A, on sale in Perth as "a synthetic preparation for the stimulation and acceleration of root growth") on a very small number of plants grown in various media in order to test the theory. No attempt at achieving results which could be tested statistically was to be tried, it was merely to see whether the theory gave any promise of being fruitful. A number of plants were to be kept as controls.

By the middle of July, 1946, the plants had grown sufficient root (above a quarter of an inch) for the trial to commence. They were divided into two groups, the control containing nine plants and the experimental eight, these being all that had germinated out of more than 50 seeds collected. The untreated control plants failed to thrive and the last survivor withered and almost dead, was placed in preservative at the end of August.

The group to be experimented on was divided as follows:

- (a) two plants which were to be grown in soil and then have the hormone poured on;
- (b) six plants which were to have their roots immersed in hormone for 24 hours.

Group (a) was treated as follows:

- i one plant was placed in a pot of yellow sand;
- ii the second plant was placed in a pot filled with sod taken from the bush and in which a Hare Orchid (*Leptoceras* sp.) was growing.

After being thus planted for a week, the hormone solution referred to above was poured over the pots until the soil was saturated. The dilution used was $\frac{1}{2}$ cc. of Hortomone per half-pint of water. The pots were sheltered for 24 hours and then placed out in the open.

Group (b) was treated thus:

- i Two plants were placed one each in pots of clean yellow sand and every 2-3 weeks were given nutrient solutions similar to that required for growing plants in a mineral aggregate.
- ii Four plants were grown in a liquid nutrient solution by which it was hoped that root growth could be observed.

RESULTS.

Group (b) ii was not successful. After two weeks, the plants showed no sign of growth and a week later the roots began to turn brown and rot. The plants were then taken from the solution and placed in a dish of moist wood shavings. By August 18, rotting had stopped and root "buds" were showing around the scar at the base of the hypocotyl.

On August 18, a seed of small prickly *Acacia* was planted in the pot of Group (a) i and in one pot of Group (b) i. This was



FIG. 2.—Left: Plant of Group (b) 1, August, 1947; this is the plant that has never had a host. Right: Plant of Group (a) ii, August, 1947; this plant apparently killed a native legume, but the *Verticordia* in the background remained unaffected.

done as a check to see whether the *Nuytsia* would establish a host-parasite relationship.

A week later the position was as follows: a specimen in group (b) ii was destroyed by insects and the specimen in group (b) i with which the *Acacia* was planted was dead from causes unknown.

By regularly removing specimens from shavings a check on root growth was kept. One specimen had the root broken several times and little growth ensued, only one root developed. The other two were as follows: September 14, a specimen with three roots, the longest being 2.3 cm., and a specimen having two roots, which were 3.4 cm., long. (Fig. 1). By October 3, these had increased to 5.0 and 6.4 cm. respectively.

On October 12, the plant having three roots was removed from the shavings and placed in the pot from which the specimen of group (b) i had died and in which the *Acacia* had now developed to the second leaf stage. An *Acacia* planted at the same time as this was grown under similar conditions as a control. By March 7, 1947, the Christmas Tree was showing distinct signs of killing the *Acacia* which was then only 5½ inches in height, with very small yellow leaves, as against 14½ inches in the control. On April 2, the soil was carefully washed from the roots of these plants and although the roots were in intimate contact, nothing approaching the typical sucker found in the native state could be seen.

Shortly after the trial had commenced, seeds germinated in the pot of group (a) ii; one was believed to be a *Verticordia* and the other one of the native Leguminosae. The one believed to be a *Verticordia* remained quite unaffected, but the legume turned yellow and died in March, 1947.

By mid-November, 1946, the plant in Group (b) i was easily the largest of all and by this time it was noticeable that in pots where *Nuytsia* and *Acacias* were growing together, the *Acacias* were much smaller than the controls.

Late in December, 1946, the remaining plant growing in shavings was placed in nutrient solution; but by the end of February, 1947, the roots had begun to rot and the specimen was discarded. At this time, the plant in Group (b) i was easily the largest specimen and was sending out vigorous lateral shoots, being the only plant behaving in this way.

The plant formerly of Group (b) ii and noted as having developed only one root had been earlier moved from shavings and placed in a pot with a gum tree (*Eucalyptus* sp.). By March 16, 1947, this plant was very yellow and stunted. The soil of this pot had never been watered with acidified nutrient solution and the yellow symptoms were taken as typical of iron lack. The plant was removed from soil by careful washing and although the roots appeared in intimate contact with the gum, no haustoria could be seen.

The plants remaining alive in April, 1947, were transplanted to larger pots and a summary of results at this time is as follows:

1. All the control plants died early in the trial.



FIG. 3.—Left: Plant of Group (b) i. Right: Plant of Group (a) ii; both photographed in August, 1947.

—All photos by A. Main

2. Of the experimental plants, Group (a) i and ii, were still alive, i living now without a host.
3. Group (b) i. One plant had died from unknown causes, but the second plant of this group was now easily the largest of all the plants and had never had a host or other plant growing in the same pot.
4. Group (b) ii. This had not been successful. One plant had been killed by insects, and one had grown in shavings until late December, but had finally died in hydroponics in February.
5. Another plant of the (b) ii series had been grown in media and finally with a Eucalypt as related above. This did not die naturally but was considered to be dying of iron lack when its root system was examined.
6. The fourth plant of the (b) ii group was still alive but was the smallest of all the surviving plants, after being in shavings, then with an Acacia which died (presumably because of the effect of the *Nuytsia*) and then finally in sand.

CONCLUSION.

As far as the restricted aim of the trial goes, the experiment was a success and it seems that root growth as a result of hormone action is capable of sustaining the plant in a normal environment. Further more extensive trials are required to demonstrate this conclusively. Also a close microscopic study of root formation before and after treatment will be necessary before a more definite statement can be made.

Other results are that after treated plants have commenced root growth they are extremely hardy and will successfully resist many changes of environment. Also host plants are not essential. The plant in group (b) i was outstandingly successful and had no host. Even plants which had an opportunity of getting hosts and supposedly killed them showed no particular gain when they were parasites, nor any particular retardation when deprived of the supposed host. It thus appears that, given the opportunity, *Nuytsia* will become parasitic but deprived of this, it is capable of normal green plant nutrition.

REFERENCE.

- Herbert, D. A. "*Nuytsia floribunda* (the Christmas Tree)---its Structure and Parasitism," *Proc. Royal Society of W. Australia*, vol. 5, 1920, pp. 72-88.

FLYING FOXES IN WESTERN AUSTRALIA

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When Captain Cook laid up his ship for repairs at the mouth of a river he subsequently named the Endeavour, in the north of Queensland, one of the crew who had wandered inland, reported that he had seen a curious and fearsome beast which he thought